

REMARKS

Claims 1-36 are pending in this application. Claims 14, 15, 35, and 36 are allowed. Claims 1-9, 16-29, and 32-34 are rejected. Claims 10-13, 30, and 31 are objected to. Claims 1, 3-6, and 9 have been amended. Claims 2 and 10 have been cancelled.

First, Applicants acknowledge with appreciation the Examiner's allowance of Claims 14, 15, 35, and 36.

Claims 2-4, 6-8, and 17-24 were rejected under 35 USC 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the Applicants regard as their invention. Specifically, the Examiner noted that the term "a cat ear power supply" in Claims 2, 6, and 17 is vague because the disclosure does not explain how this name relates to the power supply. The Examiner also stated that claims 3 and 4 are indefinite by virtue of their dependency on claim 2; claims 7 and 8 are indefinite by virtue of their dependency on claim 6; and claims 18 - 24 are indefinite by virtue of their dependency on claim 17.

Applicants respectfully draw the Examiners attention to page 4, lines 20 - 31 of the SUMMARY OF THE INVENTION in the current application, where "a cat ear power supply" is disclosed. Specifically, the application describes how the name relates to the power supply: "The cat ear power supply derives its name from the shape of its input current waveform which 'fills in' the current waveform drawn by the ballast from the AC mains around the zero crossings." Figure 28 provides a diagram of a simplified waveform illustrating the line current drawn by the cat ear power supply. Applicants note that each positive cycle of this waveform resembles the upright ears of a cat -- hence, the name "cat ear" power supply.

Applicants respectfully draw the Examiners attention to a detailed description of the car ear power supply from page 20, line 25 through page 23, line 15 of the DETAILED DESCRIPTION OF THE INVENTION. The application provides the definition of a cat ear power supply as "a power supply that is designed to draw current from the line during predetermined portions of the line cycle." Thus, the cat ear power supply can be used to shape the ballast input current waveform, which leads to improved ballast power factor and reduced

ballast input current THD. Figures 29 and 30 provide simplified schematic diagrams of the first and second embodiments of the cat ear power supply, respectively.

Accordingly, Applicants submit that the phrase "a cat ear power supply" is not vague. Withdrawal of the rejection of claims 2-4, 6-8, and 17-24 under 35 USC 112, second paragraph, is respectfully requested.

Claims 1-9, 17, 32, 33, and 34 were rejected under 35 USC 102(e) as being unpatentable over U.S. Patent 6,316,883 to Cho et al.

Regarding Claim 1, the Examiner stated that Cho et al. disclose an electronic ballast for driving a discharge lamp, the ballast drawing an essentially sinusoidal AC input current from an AC power supply, the ballast comprising: a rectifier for rectifying said AC input voltage from said AC power supply to produce a rectified bus voltage; an inverter for converting said rectified bus voltage to a high-frequency AC drive voltage to drive said lamp; and a valley-fill circuit as a current drawing means coupled to receive said rectified bus voltage for selectively drawing current from said AC power supply so that the input current to said ballast is essentially sinusoidal.

Claim 1 has been amended to incorporate the limitations of Claim 2, such that the current drawing means now includes a cat ear power supply for selectively drawing current from an AC power supply. Applicants submit that Cho et al. disclose using a valley-fill DC power supply circuit and does not teach or disclose using a cat ear power supply to draw input current around the zero crossings of the AC input voltage. Applicants note that the valley-fill circuit (830) and the power supply circuit (884) of the present application are separate blocks of the ballast circuit as seen in Figure 2 and provide separate functions. Applicants submit that amended Claim 1 is believed to meet the requirements for patentability.

Regarding Claim 3, the Examiner stated that Cho et al. disclose that the power supply includes means for drawing current from said AC power supply when said input voltage waveform is less than a predetermined value. Claim 3 includes the limitation of using a cat ear power supply. Applicants submit that Cho et al. neither teach nor disclose specifically using a

cat ear power supply as shown above and that Claim 3 is believed to meet the requirements for patentability.

Regarding Claim 4, the Examiner stated that Cho et al. disclose that the power supply includes means for drawing current from said AC power supply when the current drawn by said inverter is substantially zero. Claim 4 includes the limitation of using a cat ear power supply. Applicants submit that Cho et al. neither teach nor disclose specifically using a cat ear power supply as shown above and that Claim 4 is believed to meet the requirements for patentability.

Regarding Claim 5, the Examiner stated that Cho et al. disclose an electronic ballast for driving a gas discharge lamp, the ballast having improved input current total harmonic distortion (THD), the ballast comprising: a rectifier for rectifying an AC input voltage from an AC power supply to produce a rectified bus voltage; an inverter for converting the rectified bus voltage to a high-frequency AC output voltage to drive said lamp; and means for drawing current from the AC power supply near the zero crossing of the AC input voltage so that the input current THD is substantially reduced.

Claim 5 has been amended to incorporate the limitations of Claim 6, such that said means for drawing current now includes a cat ear power supply. Applicants submit that Cho et al. disclose using a valley-fill DC power supply circuit and does not teach or disclose using a cat ear power supply to draw input current around the zero crossings. Applicants note that the valley-fill circuit (830) and the power supply circuit (884) of the present application are separate blocks of the ballast circuit as seen in Figure 2 and provide separate functions. The cat ear power supply is designed to draw current from the AC power supply near the zero crossings of the AC input voltage because the valley-fill circuit does not. Applicants submit that amended Claim 5 is believed to meet the requirements for patentability.

Regarding Claim 6, the Examiner stated that Cho et al. disclose a control circuit connected to drive said inverter; and wherein said means for drawing comprises a power supply for supplying power to operate said control circuit. Applicants acknowledge that Cho et al. disclose a drive circuit for controlling the inverter circuit; however, Applicants submit that Cho

et al. neither teach nor disclose using a cat ear power supply to supply the power to operate the drive circuit. Applicants submit that Claim 6 is believed to meet the requirements for patentability.

Regarding Claim 7, the Examiner stated that Cho et al. disclose that the power supply includes means for drawing current from said AC power supply when said input voltage waveform is less than a predetermined value. Claim 7 includes the limitation of using a cat ear power supply. Applicants submit that Cho et al. neither teach nor disclose specifically using a cat ear power supply as shown above and that Claim 7 is believed to meet the requirements for patentability.

Regarding Claim 8, the Examiner stated that Cho et al. disclose that the power supply includes means for drawing current from said AC power supply when the current drawn by said inverter is substantially zero. Claim 8 includes the limitation of using a cat ear power supply. Applicants submit that Cho et al. neither teach nor disclose specifically using a cat ear power supply as shown above and that Claim 8 is believed to meet the requirements for patentability.

Regarding Claim 9, the Examiner stated that Cho et al. disclose an electronic ballast for driving a gas discharge lamp, the ballast having improved power factor and total harmonic distortion, the ballast comprising: a rectifier for rectifying an AC input voltage from an AC power supply to produce a rectified bus voltage; a valley-fill circuit having an energy storage device, said valley-fill circuit electrically coupled to receive said rectified bus voltage; an inverter for converting said rectified bus voltage to a high-frequency AC output voltage to drive said lamp; and energy delivery control means for controlling the delivery of energy to said energy storage device over a substantial portion of each half-cycle of the AC input voltage so that the ballast power factor and THD are substantially improved.

Claim 9 has been amended to incorporate the limitations of Claim 10, such that said energy delivery control means now includes a buck inductor. The Examiner stated that Claim 10 was objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any

intervening claims. Applicants submit that amended Claim 9 is believed to meet the requirements for patentability.

Regarding Claim 17, the Examiner stated that Cho et al. disclose an electronic ballast for driving a gas discharge lamp, the ballast including a rectifier for receiving a supply of sinusoidal alternating current power and producing a rectified direct current bus voltage, a valley-fill circuit for receiving the rectified direct current bus voltage and maintaining the bus voltage above a predetermined minimum voltage, an inverter for receiving the bus voltage and producing a high-frequency alternating current voltage for driving the gas discharge lamp, and a control circuit for producing control signals to control the operation of the inverter, the ballast comprising: a power supply (Cdc1, Cdc2) for supplying power to the control circuit, said power supply adapted to draw power from the supply of sinusoidal alternating current power only during a predetermined portion of each half-cycle of the sinusoidal alternating current power.

Applicants believe that the capacitors Cdc1 and Cdc2 are not a power supply for supplying power to a control circuit, but are DC-link capacitors for alternatively storing energy for and releasing energy to the inverter (2). Cho et al. neither teach nor disclose any sort of power supply for supplying power to the drive circuit (3). Referring to Applicants' Figure 2, the power supply (884) taught in the present application is a cat ear power supply, which is separate from the valley fill circuit (830) and supplies power to the control circuit (882). Applicants submit that Claim 17 is believed to meet the requirements for patentability and request that the rejection of Claim 17 under 35 USC 102(e) be withdrawn.

Regarding Claim 32, the Examiner stated that Cho et al. disclose an electronic ballast for driving a gas discharge lamp, including: a rectifier for receiving a supply of sinusoidal alternating current power and producing a rectified direct current bus voltage; a valley-fill circuit for receiving the rectified direct current bus voltage and maintaining the bus voltage above a predetermined minimum voltage; an inverter for receiving the bus voltage and producing a high-frequency alternating current voltage for driving the gas discharge lamp; and a control circuit for producing control signals to control the operation of the inverter; the improvement comprising: a power supply (Cdc1 and Cdc2) operatively connected to draw power from said supply of sinusoidal alternating current power, said power supply further operatively connected to supply

power to said control circuit, said power supply being the sole source of power for said control circuit.

Applicants believe that the capacitors Cdc1 and Cdc2 are not a power supply for supplying power to a control circuit, but are DC-link capacitors for alternatively storing and releasing energy in the valley-fill circuit (4). In this case, Cdc1 and Cdc2 are supplying power to the lamps, not the drive circuit (3). Cho et al. neither teach nor disclose any sort of power supply for supplying power to the drive circuit. Referring to Applicants' Figure 2, the power supply (884) taught in the present application is a cat ear power supply, which is separate from the valley fill circuit (830) and supplies power to the control circuit (882). Applicants submit that Claim 32 is believed to meet the requirements for patentability and request that the rejection of Claim 32 under 35 USC 102(e) be withdrawn.

Regarding Claim 33, the Examiner stated that Cho et al. disclose the power supply comprises means for drawing power from said supply of sinusoidal alternating current power during a predetermined portion of each half-cycle of said sinusoidal alternating current power. Applicants submit that Claim 33 is believed to be patentable because it is dependent on Claim 32, which is believed to be patentable for the reasons noted above. Claim 32 includes the limitation of said power supply further operatively connected to supply power to said control circuit. Cho et al. neither teach nor disclose any sort of power supply for supplying power to the drive circuit (3).

Regarding Claim 34, the Examiner stated that Cho et al. disclose a method for causing an electronic ballast, of the type including a control circuit, to draw more nearly sinusoidal input current from a source of sinusoidal alternating current power, said method comprising the steps of: providing a power supply in said ballast for drawing current from said source of sinusoidal alternating current power during a predetermined portion of each half-cycle of said sinusoidal alternating current power; causing said power supply to draw said current from said source of sinusoidal alternating current power during said predetermined portion of each half-cycle of said sinusoidal alternating current power; and causing said power supply to supply power to said control circuit throughout each said half-cycle. Cho et al. neither teach nor disclose any sort of power supply for supplying power to the drive circuit (3). Applicants submit

that Claim 34 is believed to meet the requirements for patentability and request that the rejection of Claim 34 under 35 USC 102(e) be withdrawn.

Claims 16 and 25-29 were rejected under 35 USC 102(b) as being anticipated by U.S. Patent 5,925,990 to Crouse et al.

Regarding Claim 16, the Examiner stated that Crouse et al. disclose an electronic ballast for driving a gas discharge lamp, the ballast including a valley-fill circuit including a bus capacitor, the ballast having integral over-voltage protection for the bus capacitor, the ballast comprising: a rectifier; an inverter; and said valley-fill circuit connected between said rectifier and said inverter, said valley-fill circuit including a buck converter connected between an output of said rectifier and an input of said inverter.

Applicants submit that Crouse et al. neither teach nor disclose a valley-fill circuit including a buck converter. In contrast, Crouse et al. teach a boost section (52) for increasing the DC voltage from the converter section (51) (column 4, lines 8-15). In addition, Crouse et al. do not teach integral over-voltage protection for the bus capacitor (53). Applicants submit that Claim 16 is believed to meet the requirements for patentability and request that the rejection of Claim 16 under 35 USC 102(b) be withdrawn.

Regarding Claim 25, the Examiner stated that Crouse et al. disclose an electronic ballast for driving a gas discharge lamp, the ballast comprising: a rectifier for receiving a supply of sinusoidal alternating current power and producing a rectified direct current bus voltage; a valley-fill circuit for receiving the rectified direct current bus voltage and maintaining the bus voltage above a predetermined minimum voltage; an inverter for receiving the bus voltage and producing a high-frequency alternating current voltage for driving the gas discharge lamp; and a control circuit for producing control signals to control the operation of the inverter; said valley-fill circuit including an energy storage element, an impedance, and a switch; said energy storage element adapted to be connected between said bus voltage and a circuit common by means of said impedance when said switch is in a first predetermined conductive state so as to store energy.

Applicants submit that Crouse et al. neither teach nor disclose an energy storage element adapted to be connected between a bus voltage and a circuit common by means of an impedance when a switch is in a first predetermined conductive state. The energy storage means (53) of Crouse et al. is always connected directly between the bus voltage and circuit common as seen in Figure 2. Further, Crouse et al. neither teach nor disclose a valley-fill circuit. Rather, Crouse et al. disclose a boost section (52) after the rectifier (51). Applicants submit that Claim 25 is believed to meet the requirements for patentability and request that the rejection of Claim 25 under 35 USC 102(b) be withdrawn.

Applicants submit that Claims 26, 27, 28, and 29 are believed to be patentable over the art of record because they are dependent on Claim 25, which is believed to be patentable for the reasons noted above. Applicants request that the rejection of Claims 26, 27, 28, and 29 under 35 USC 102(b) be withdrawn.

The Examiner stated that Claims 10-13, 30, and 31 are objected to as being dependent upon a rejected base claim. Claim 10 has been cancelled. Claims 11, 12, and 13 are believed to be allowable because the claim they depend from, Claim 9, has been amended, and is believed to be patentable for the reasons given above. Claims 30 and 31 are believed to be allowable because they ultimately depend from Claim 25, which is believed to be patentable as discussed in the remarks above.

The Examiner stated that Claims 18-24 would be allowable if rewritten to overcome the rejection(s) under 35 USC 112, second paragraph. Applicants respectfully submit that the Specification, as noted above, contains a written description of the invention in such, full clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, to make and use the same. Accordingly, Applicants submit that Claims 18-24 particularly point out and distinctly claim the subject matter that they regard as their invention. Withdrawal of the objection of claims 18-24 under 35 USC 112, second paragraph, is respectfully requested.

Applicants submit that in view of the facts and reasons set forth above, this application is believed to be in condition for allowance, and request early notification to this effect.

Respectfully Submitted,

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IN THE CLAIMS:

1. (Amended) An electronic ballast for driving a gas discharge lamp, the ballast drawing an essentially sinusoidal AC input current from an AC power supply, the ballast comprising:

a rectifier for rectifying said AC input voltage from said AC power supply to produce a rectified bus voltage;

an inverter for converting said rectified bus voltage to a high-frequency AC drive voltage to drive said lamp; and

current drawing means coupled to receive said rectified bus voltage for selectively drawing current from said AC power supply so that the input current to said ballast is essentially sinusoidal; said current drawing means including a cat ear power supply.

3. (Amended) The electronic ballast according to claim [2] 1 wherein said cat ear power supply includes means for drawing current from said AC power supply when said AC input voltage waveform is less than a predetermined value.

4. (Amended) The electronic ballast according to claim [2] 1 wherein said cat ear power supply includes means for drawing current from said AC power supply when the current drawn by said inverter from is substantially zero.

5. (Amended) An electronic ballast for driving a gas discharge lamp, the ballast having improved input current total harmonic distortion (THD), the ballast comprising:

a rectifier for rectifying an AC input voltage from an AC power supply to produce a rectified bus voltage;

an inverter for converting the rectified bus voltage to a high-frequency AC output voltage to drive said lamp; and

means for drawing current from the AC power supply near the zero crossing of the AC input voltage so that the input current THD is substantially reduced; said means for drawing current including a cat ear power supply.

Version with Markings to Show Changes Made

6. (Amended) The electronic ballast according to claim 5 further comprising a control circuit connected to drive said inverter; and

wherein said [means for drawing comprises a] cat ear power supply [for supplying] supplies power to operate said control circuit.

9. (Amended) An electronic ballast for driving a gas discharge lamp, the ballast having improved power factor and total harmonic distortion, the ballast comprising:

a rectifier for rectifying an AC input voltage from an AC power supply to produce a rectified bus voltage;

a valley-fill circuit having an energy storage device, said valley-fill circuit electrically coupled to receive said rectified bus voltage;

an inverter for converting said rectified bus voltage to a high-frequency AC output voltage to drive said lamp; and

energy delivery control means for controlling the delivery of energy to said energy storage device over a substantial portion of each half-cycle of the AC input voltage so that the ballast power factor and THD are substantially improved; said energy delivery control means including a buck inductor.